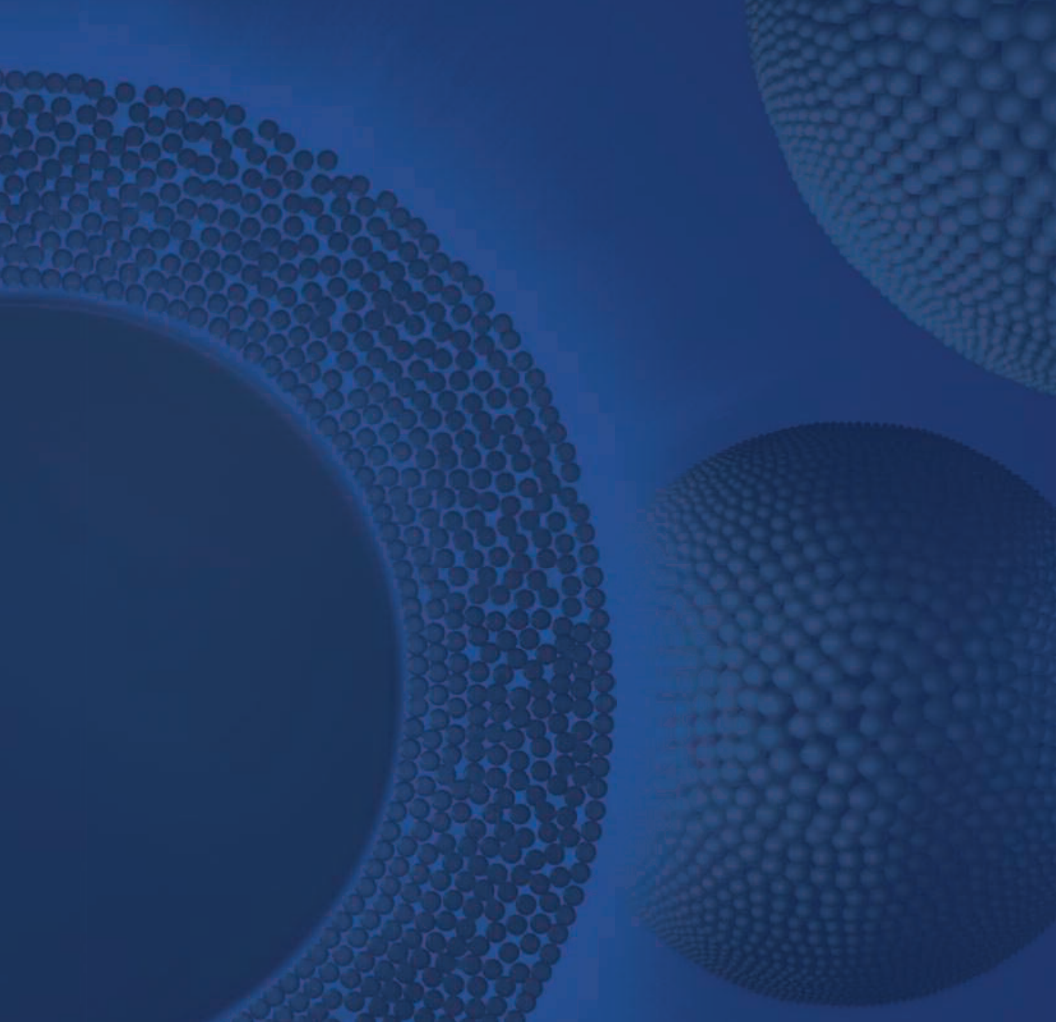
HALO PFP UHPLC COLUMNS

HALO®

The name that defines a new direction in UHPLC separations.



UHPLC columns compatible with both UHPLC and conventional HPLC equipment

HALO® PFP UHPLC Columns

- Versatile UHPLC columns that can be used with either UHPLC or conventional HPLC equipment
- An alternate bonded phase selectivity to achieve separations not possible with other bonded phases
- Particularly recommended for bases and halogenated compounds
- Compatible with highly aqueous mobile phases to facilitate the retention and separation of polar compounds
- Stable bonded phase provides durable, long-lived performance plus minimum bleed for LC/MS applications
- Base-deactivated for good peak shape when separating basic compounds
- Moderate back pressure places less stress on UHPLC equipment and permits these UHPLC columns to be used with conventional HPLC equipment.
- The use of 2 µm porosity column inlet frits reduces the inconvenience caused by pressure increases from plugged frits and makes HALO columns more forgiving and easier to use than columns packed with sub-2 µm particles.

HALO Fused-Core® particle technology facilitates ultra-fast, high resolution UHPLC separations with either UHPLC or conventional HPLC equipment. Now HALO columns packed with a pentafluorophenyl phase (PFP) join HALO C18, C8, RP-Amide, Phenyl-Hexyl and HILIC phases to offer a wide range of powerful selectivity choices to accomplish the most demanding separations. HALO PFP is particularly well suited for the separation of halogenated compounds, nitro-aromatic compounds, and polar bases. HALO PFP definitely should be considered when a C18 or C8 phase fails to provide an adequate separation. HALO PFP columns are also well suited for the separation of highly water soluble compounds that require high aqueous mobile phases and generally provide greater retention for bases than C18 phases.

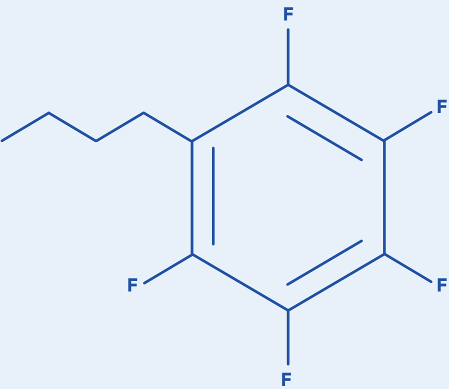
HALO PFP uses proprietary bonding chemistry to achieve excellent stability and long column life. The extremely low bleed characteristics of the HALO PFP phase make it particularly well suited for LC/MS applications.

As with all HALO phases, the combination of ultra-pure reagents, "Type B" silica, dense bonding technology, and optimized endcapping produce a base-deactivated stationary phase that provides excellent peak shape for basic compounds.

Mechanism of Separation

Reversed phase separations on HALO PFP columns are primarily influenced by hydrogen bonding and dipole-dipole interactions. However, π–π interactions and mild hydrophobic binding interactions often contribute to retention and selectivity. In addition, the polar PFP group makes the HALO PFP phase a suitable choice for HILIC applications. (See Figure 1 for the structure of the PFP bonded phase.)

FIGURE 1: Structure of HALO PFP bonded phase



Pentafluorophenylpropyl is the bonded phase used for HALO PFP.

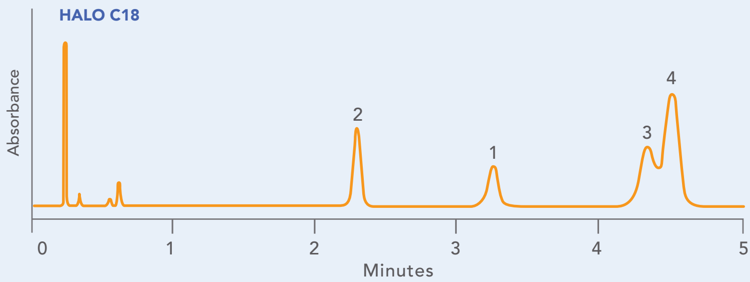
> *The fused-core silica column providing the reduced diffusional mass transfer path allows the use of shorter columns and higher flow rates to achieve remarkably fast high-resolution separations.*
>
> Analytical Chemistry, August 2007

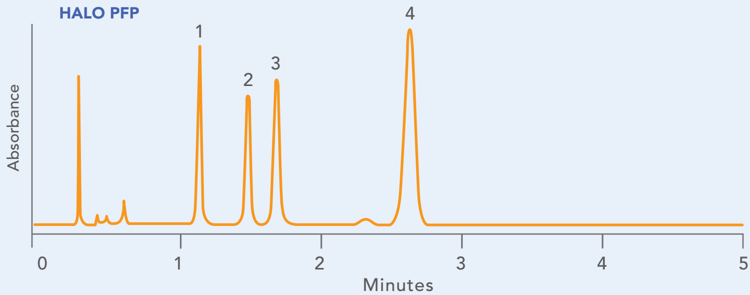
Figure 2 illustrates the difference in selectivity offered by HALO PFP versus HALO C18. The improved separation of 1-phenylnaphthalene and pyrene on HALO PFP is due to π–π interactions. The stronger hydrophobic binding interaction on the HALO C18 is responsible for the longer retention of butylbenzene and for the dramatic difference in selectivity represented by the change in elution order between butylbenzene and acenaphthene on HALO C18 versus HALO PFP.

FIGURE 2: HALO PFP offers an alternate selectivity to HALO C18

TEST CONDITIONS:
Column Dimensions: 4.6 x 50 mm
Mobile Phase: 30/70 water/methanol
Flow Rate: 2.0 mL/min.
Pressure: approximately 250 Bar
Temperature: 40 °C
Detection: UV 254 nm, VWD

PEAK IDENTITIES:
1. Butylbenzene
2. Acenaphthene
3. 1-Phenylnaphthalene
4. Pyrene





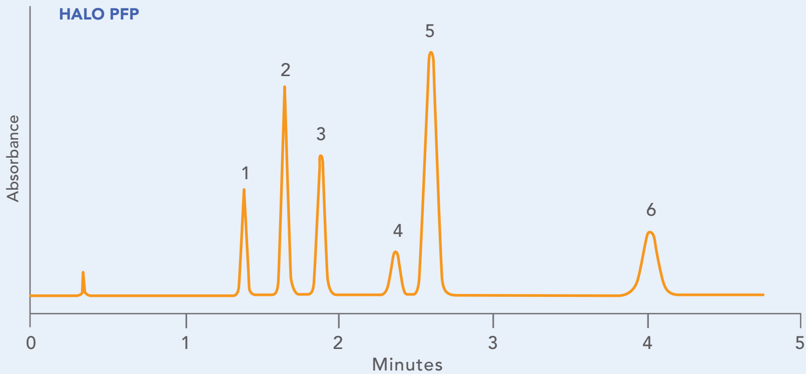
This separation of neutral aromatic compounds illustrates the differences in selectivity between HALO PFP and HALO C18. The π-π interactions offered by the PFP phase and the stronger hydrophobic interactions of the C18 phase lead to significant differences in band spacing and even peak elution order on the two phases. This difference in selectivity makes HALO PFP an extremely useful alternate selectivity to the HALO C18 phase that should be evaluated when developing separations.

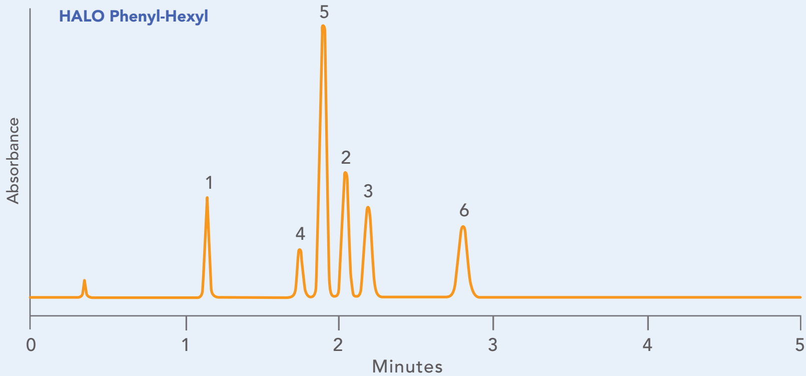
Figure 3 illustrates the role that dipole-dipole interactions and π–π interaction play in achieving a separation. Although it is difficult to identify which interaction is most dominant for each analyte, these comparison chromatograms clearly show that these different mechanisms of separation (dipole-dipole interactions more dominant with the PFP phase and π–π and hydrophobic interactions more dominant with the Phenyl-Hexyl phase) can be used to develop a satisfactory separation.

FIGURE 3: HALO PFP and HALO Phenyl-Hexyl offer different selectivity

TEST CONDITIONS:
Column Dimensions: 4.6 x 50 mm
Mobile Phase: 45/55 water/methanol
Flow Rate: 1.5 mL/min.
Pressure: approximately 200 Bar
Temperature: 40 °C
Detection: UV 254 nm, VWD

PEAK IDENTITIES:
1. Nitrobenzene
2. 1-Cl-4-Nitrobenzene
3. 2,6-Dinitrotoluene
4. 4-Nitrotoluene
5. 3-Nitrotoluene
6. 4-Cl-3-Nitroanisole

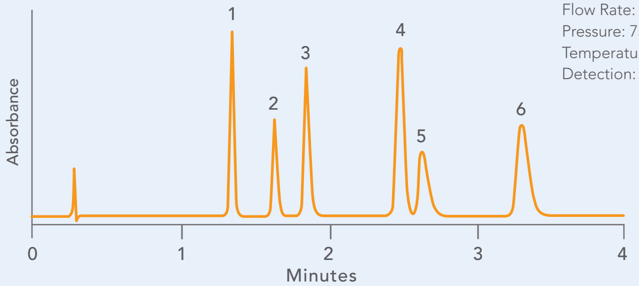




These comparison chromatograms clearly show the effect of different mechanisms of separation: dipole-dipole interactions more dominant with the PFP phase and π-π and hydrophobic interactions more dominant with the Phenyl-Hexyl phase. These differences in interaction between analytes and stationary phase can be utilized to achieve superior separations.

Figure 4 provides an example of the great versatility of HALO PFP. Here, basic drugs are separated using HILIC mode. This can be particularly useful for separating polar compounds that are poorly retained in reversed phase mode. In addition, HILIC mode typically involves operating with higher amounts of organic component in the mobile phase than reversed phase mode, thus enhancing sensitivity when using LC/MS.

FIGURE 4: The versatility of HALO PFP is shown in this separation of basic drugs using HILIC mode of separation

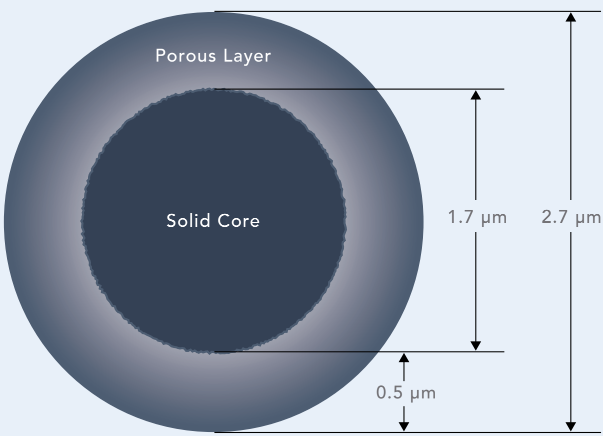


TEST CONDITIONS:
Column Dimensions: 4.6 x 50 mm
Mobile Phase: 12/88 0.01 M ammonium formate buffer, pH=3.0 /Acetonitrile
Flow Rate: 1.5 mL/min.
Pressure: 75 Bar
Temperature: 30 °C
Detection: UV 254 nm, VWD

PEAK IDENTITIES:
1. Phenylephrine
2. Trazadone
3. Procaine
4. Amoxapine
5. Propranolol
6. Desipramine

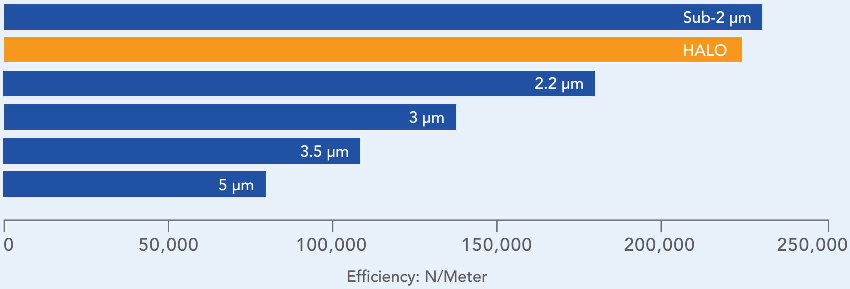
Highly polar compounds that are poorly retained in reversed phase mode can be strongly retained on HALO PFP using HILIC mode. HILIC often provides higher sensitivity for LC-MS applications due to the higher concentration of organic component in the mobile phase.

FIGURE 5: Fused-Core Particle Technology



Fused-Core particle technology was conceived of and developed by Dr. Jack Kirkland to produce HPLC columns that deliver UHPLC performance with conventional HPLC equipment. As the name implies, Fused-Core particles are manufactured by fusing a porous silica layer onto a solid silica particle.

FIGURE 6: HALO columns deliver more separating power



HALO columns deliver over 90% more separating power (theoretical plates) than columns of the same length packed with 3.5 µm particles and almost three times the separating power of columns packed with 5 µm particles.

Note: N/Meter values were calculated at the optimum mobile phase linear velocity for each of these stationary phases.

HALO UHPLC Columns | High resolution, Hyper-fast, Super-rugged

HALO Fused-Core particles are designed for high speed, high resolution liquid chromatography. They are unique particles consisting of a 0.5 µm porous silica "halo" fused to a 1.7 µm solid silica core (Figure 5). The high density and extremely narrow size distribution of these Fused-Core particles facilitate the packing of columns with unexpectedly high efficiencies—efficiencies more in line with what you would expect from columns packed with sub-2 µm particles. The reason for this unexpectedly high efficiency is apparently the unusually well-ordered packed bed that minimizes the eddy diffusion contribution to band broadening. HALO columns do, however, generate the back pressure that one would expect from columns packed with 2.7 µm size particles. This pressure is low enough to permit HALO columns to be used effectively with conventional HPLC equipment, avoiding the need to purchase expensive UHPLC equipment. However, to take full advantage of the UHPLC performance offered by these columns, the use of UHPLC equipment is encouraged.

HALO columns deliver over 90% more separating power (theoretical plates) than a column of the same length packed with 3.5 µm particles and almost three times the plates of a column packed with 5 µm particles (Figure 6). And, because of Fused-Core particle technology, HALO columns maintain their resolving power at high mobile phase velocity. This means that shorter columns and higher flow velocities can be used to achieve remarkably fast high resolution separations.

The combination of extremely narrow particle size distribution and very dense particles allows for the production of columns that are incredibly rugged and reliable, even when used under conditions of high pressure and high flow velocity. In addition, the narrow size distribution of the Fused-Core particles permits the use of 2 µm porosity inlet frits on HALO columns. This is the same inlet frit porosity typically found on columns packed with 5 µm particles. As a result, HALO columns are capable of delivering speed and resolution similar to columns packed with sub-2 µm particles, but with the ease of use and durability of columns packed with 5 µm particles.

HALO® Specifications

Stationary Phase Support

- Ultra-pure, "Type B" silica
- Particle Size: 2.7 microns (1.7 micron solid core particle with a 0.5 micron porous silica layer fused to the surface)
- 150 m^2/gram surface area
- 90 Å pore size

Bonded Phase

- Pentafluorophenylpropyl
- Densely bonded phase (ca. 3.6 µmoles/m^2)
- Optimized endcapping

Maximum Pressure: 9,000 psi, 600 Bar
pH Range: 2 to 8

HALO® PFP Ordering Information

HALO® 2.7 µm Fused-Core® Columns

Description (mm)	Part Number
2.1 X 30mm	92812-307
2.1 X 50mm	92812-407
2.1 X 75mm	92812-507
2.1 X 100mm	92812-607
2.1 X 150mm	92812-707
3.0 X 30mm	92813-307
3.0 X 50mm	92813-407
3.0 X 75mm	92813-507
3.0 X 100mm	92813-607
3.0 X 150mm	92813-707
4.6 X 30mm	92814-307
4.6 X 50mm	92814-407
4.6 X 75mm	92814-507
4.6 X 100mm	92814-607
4.6 X 150mm	92814-707

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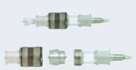
Lieferprogramm HALO™ HPLC-Säulen

- Das Original von Advanced Materials Technology
- Hochreines "Type B" Silicamaterial • Druckstabil bis 600 bar
- Garantiert mehr als 200.000 theoretische Böden pro Meter
- Verwendbar in konventionellen HPLC-Anlagen
- Erlaubt extrem kurze Analysenzeiten

Halo™ LxID [mm]	C18 Best.-Nr.	C8 Best.-Nr.	HILIC Best.-Nr.	Phenyl-Hexyl Best.-Nr.	PFP Best.-Nr. NEU!	€	RP-Amide Best.-Nr.	€	Peptide ES-C18 Best.-Nr.	€
50x0,075	98219-402	98219-408				450,--				
150x0,075	98219-702	98219-708				585,--				
50 x 0,1	98218-402	98218-408				450,--				
150 x 0,1	98218-702	98218-708				585,--				
50 x 0,2	98217-402	98217-408				450,--				
150 x 0,2	98217-702	98217-708				585,--				
50 x 0,3	98216-402	98216-408				450,--				
150 x 0,3	98216-702	98216-708				585,--				
50 x 1,0	92811-402					325,--				
100 x 1,0	92811-602					500,--				
150 x 1,0	92811-702					585,--				
20 x 2,1	92812-202	92812-208	92812-201	92812-206	92812-209	325,--	92812-207	360,--		
30 x 2,1	92812-302	92812-308	92812-301	92812-306	92812-309	325,--	92812-307	360,--	92122-302	325,--
50 x 2,1	92812-402	92812-408	92812-401	92812-406	92812-409	420,--	92812-407	455,--	92122-402	420,--
75 x 2,1	92812-502	92812-508	92812-501	92812-506	92812-509	450,--	92812-507	485,--	92122-502	450,--
100 x 2,1	92812-602	92812-608	92812-601	92812-606	92812-609	500,--	92812-607	540,--	92122-602	500,--
150 x 2,1	92812-702	92812-708	92812-701	92812-706	92812-709	585,--	92812-707	620,--	92122-702	585,--
20 x 3,0	92813-202	92813-208	92813-201	92813-206		325,--	92813-207	360,--		
30 x 3,0	92813-302	92813-308	92813-301	92813-306	92813-309	325,--	92813-307	360,--	92123-302	325,--
50 x 3,0	92813-402	92813-408	92813-401	92813-406	92813-409	420,--	92813-407	455,--	92123-402	420,--
75 x 3,0	92813-502	92813-508	92813-501	92813-506	92813-509	450,--	92813-507	485,--	92123-502	450,--
100 x 3,0	92813-602	92813-608	92813-601	92813-606	92813-609	500,--	92813-607	540,--	92123-602	500,--
150 x 3,0	92813-702	92813-708	92813-701	92813-706	92813-709	585,--	92813-707	620,--	92123-702	585,--
20 x 4,6	92814-202	92814-208	92814-201	92814-206		325,--	92814-207	360,--		
30 x 4,6	92814-302	92814-308	92814-301	92814-306	92814-309	325,--	92814-307	360,--	92124-302	325,--
50 x 4,6	92814-402	92814-408	92814-401	92814-406	92814-409	420,--	92814-407	455,--	92124-402	420,--
75 x 4,6	92814-502	92814-508	92814-501	92814-506	92814-509	450,--	92814-507	485,--	92124-502	450,--
100 x 4,6	92814-602	92814-608	92814-601	92814-606	92814-609	500,--	92814-607	540,--	92124-602	500,--
150 x 4,6	92814-702	92814-708	92814-701	92814-706	92814-709	585,--	92814-707	620,--	92124-702	585,--

Halo™Guard Vorsäulensysteme



- Kartuschenwechsel ohne Werkzeug
- druckstabil bis 1.000 bar
- totvolumenarm
- geeignet auch für die UHPLC

Vorsäulen-kartuschen	Halo™ LxID [mm]	C18 Best.-Nr.	C8 Best.-Nr.	HILIC Best.-Nr.	Phenyl-Hexyl Best.-Nr.	PFP Best.-Nr.	RP-Amide Best.-Nr.	Peptide ES-C18	€
je 3 Stück	5 x 2,1	92812-102	92812-108	92812-101	92812-106	92812-109	92812-107	92122-102	285,--
	5 x 3,0	92813-102	92813-108	92813-101	92813-106	92813-109	92813-107	92123-102	285,--
	5 x 4,0	92814-102	92814-108	92814-101	92814-106	92814-109	92814-107	92124-102	285,--
							Halter	94900-001	220,--

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